Accuracy and Bias in Retrospective Symptom Reporting

Omer Van den Bergh & Marta Walentynowicz

Health Psychology, University of Leuven, Belgium

Correspondence to:

Omer Van den Bergh, PhD

Health Psychology

University of Leuven

Tiensestraat 102

B-3000 Leuven

Belgium

Tel: +3216326058

Email: omer.vandenbergh@kuleuven.be

Purpose of review

Self-reported bodily symptoms are of primary importance in health care and in health-related research. Typically they are assessed in clinical interviews or by means of traditional questionnaire formats that require the respondent to provide retrospective symptom estimates rated along intuitive frequency and/or intensity standards and aggregated across varying or unspecified time windows.

Recent findings

Retrospective symptom assessments are often biased when compared to (averaged) momentary assessments of symptoms. A variety of factors and conditions have been identified to influence the amount of bias in symptom reporting. Recent research has focused on the underlying mechanisms for the discrepancy between memory and experience. It is suggested that different types of questions and formats assess different types of information that each may be relevant for other purposes. Knowledge of these underlying mechanisms also provides a relevant framework to better understand individual differences in symptom reporting, including somatoform and somatic symptom disorder.

Summary

Accuracy of self-reported bodily symptoms is important for the clinician and the researcher. Understanding the mechanisms underlying bias may be provide an interesting window to understand how symptom episodes are processed, encoded and consolidated in memory and provide clues to modify symptom experiences.

Keywords

Autobiographical memory, episodic memory, somatoform disorder, self-report, symptoms

Introduction

Retrospective symptom reports play a primary role when patients consult their physician. They serve as a major source of information for further testing, clinical diagnosis, functional assessment, and informed treatment choice. Also researchers assess self-reported symptoms using standardized questionnaires and rating scales to answer a multitude of health-related research questions. Symptom questionnaires typically require the respondent to provide retrospective symptom estimates rated along intuitive frequency and/or intensity standards (seldom, frequent, almost daily; low, medium, high, etc.) and aggregated across varying or unspecified time windows (e.g. the past week, month, etc.) [1]. Such intuitive integrations of memory-based information rely on complex psychological processes that are often biasing self-reports, that is, they may not correspond closely with actually experienced symptoms.

Biases in self-reports have contributed to concerns about the validity of traditional questionnaires and to the increasing use of momentary ambulatory assessments in real time and context (ecological momentary assessment, EMA) in order to obtain more accurate, experience-near data [e.g., 2]. Since the latter are considered to provide a more objective standard, much research has been devoted to establish the amount of and the conditions for bias in retrospective symptom reports by comparing them to momentary assessments. Recently, however, research shifted towards understanding the processes underlying answers to questions about one's internal state [3]. This perspective has also opened a way to improve our understanding of stable individual differences that are reflected in elevated symptom reports, such as observed in persons with high habitual levels of symptoms, and patients with so-called medically unexplained symptoms, and somatoform and functional somatic

disorders. In this review, we will address these issues with a focus on bodily symptoms, and occasionally extend our discussion to affective and mood-related symptoms.

Accuracy and bias in retrospective symptom reports

Symptom questionnaires are often found to overestimate actually experienced symptom levels as indicated by a discrepancy between recalled symptoms and averaged EMA. This so-called memory-experience gap [4] is found in children [5,6*, 7–9] as well as in adult patients [10–14] and healthy persons [15,16,17**,18**]. Also emotions and positive and negative affect are often retrospectively overreported [7,19,20,21*] which may contribute to an illusion of positive change when comparing retrospective measures of pre-therapeutic distress with actual assessment of distress [22]. However, also accurate retrospective memory as well as underestimation of symptoms have occasionally been reported [23–26,27*]. Several factors appear to influence bias in symptom reports (see Table 1).

Insert Table 1 here

EMA provide in general more accurate and rich information by allowing to assess the variability and context dependency of symptoms. However, the burden on the respondent is rather high and sometimes application of EMA is not feasible. Alternative methods in-between EMA and classic questionnaires have been developed to assess somatic and affective symptoms in everyday life such as end-of-day diaries and the Day Reconstruction Method [53–55]. These methods may also

provide reliable estimates of symptom intensity levels as well their variability, especially if collected multiple times across the reporting period [56,57].

Understanding bias

As symptom episodes are experienced, they are processed, encoded and consolidated by the individual in functional memory (sub)systems that contribute to self-referential thinking about one's present, past and future, and help to maintain self-identity. One functional subsystem is autobiographical memory [or self-memory system; 58,59] which in the case of symptom episodes, represents unique health-related information that is contextualized in time and space and has particular relevance for the self. Another functional subsystem is personal semantic memory [60,61*] that represents information about the self that is abstracted from experience and devoid of unique contextual details, implying beliefs about one's personality, roles and general autobiographical facts. Symptom schemata and illness beliefs, reflecting commonalities across multiple symptom and illness episodes as well as semantic knowledge and lay beliefs, can be considered part of personal semantic memory. These theoretical concepts can help to understand bias in retrospective symptom reporting [see Conner & Feldman Barrett, 3].

Because the memory-experience gap, e.g. retrospective overestimation of symptoms as compared to averaged momentary assessments, appears immediately after a symptom episode [17**,35] and remains rather stable across subsequent measurements over a two-week period [17**], it is unlikely to simply result from memory decay over time. Such findings are more compatible with an idea that different types of measurement gauge different types of information, and possibly assess different "functional selves" [3,62]. First, momentary assessments reveal experiential knowledge or information provided by an experiencing self in a "here-

and-now" context. They are therefore more closely related than retrospective measures to objective measures of biobehavioral processes involved in being and behaving in that context, such as parameters of autonomic, neuro-endocrine and immune functioning as well as to affective networks in the brain that are associated with experiencing a particular state [63–65].

Second, retrospective assessments about a proximal past may probe information as it has been encoded and consolidated in autobiographic episodic memory. It reflects information from a "remembering self" that may have more interest in being adaptive to guide future behaviour rather than being accurate in representing the past [59]. For example, it may be more relevant to remember how unpleasant an aversive bodily experience was at its peak and how much it got better at the end rather than to remember (and equally weighing) every single moment of the experience. In other words, the peak-end bias in retrospective symptom reports may represent an adaptive bias [17**,33,37]. Interestingly, the peak-end rule predicted recalled labor pain up to 2 months after delivery confirming that labor duration is largely neglected. However, this effect was diluted in multiparous compared to primiparous mothers, showing that previous experience moderates the peak-end memory rule [36].

Third, probing information of a more distal past may address personal semantic memory rather than integrated and remembered episodes, reflecting a "believing self" that is more influenced by beliefs about oneself as an historical person with a particular personality, gender and cultural context. Obviously, both episodic and semantic systems may be involved in retrospective ratings to different degrees depending on factors, such as the retention interval and the availability of details [66].

Recent findings suggest that when retention intervals extend 3-7 weeks also semantic elements are used to reconstruct hedonic evaluations of past episodes [67].

The view that different ways of assessment tap into different sources of information has important consequences. When the relationship between self-reports and objective physiological measures is the focus of interest, EMA will generally result in more valid data. However, when the goal is to understand and predict future health-related decisions, treatment adherence and illness behavior of patients, remembered symptoms, symptom schemata and illness beliefs may be more relevant than actually experienced symptoms as assessed by EMA [3,68–70,71*,72*].

Understanding individual differences in symptom overreporting

The experience of a symptom entails a sensory-perceptual component referring to intensity, location, and other qualities, and an affective-motivational component providing the drive for action to preserve the integrity of the body [73–77]. A question prompting a symptom report from the individual requires an intuitive integration of both components into one global symptom report. This process is influenced by emotional states [76]. So, it is no surprise that symptom reports tend to be more elevated with higher state anxiety, distress, as well as in individuals scoring high for trait negative affectivity, a personality trait characterized by an overreactive evaluative system, elevated threat sensitivity, and vulnerability to negative emotions (see Table 1). A positive relationship between trait negative affectivity and symptom reporting shows up during controlled symptom inductions [78–81] as well as in the absence of physiological dysfunction [81–83]. High trait negative affectivity also characterizes high habitual symptom reporters among healthy persons [84*,85] as

well as patients with somatoform disorder [86,87]. Interestingly, although the anxiety and depressive component of negative affectivity are highly correlated, the first appears more associated with concurrent symptom overreporting, whereas the latter with retrospective overreporting [49]. Studies further show that anxious states and appraisals during symptom episodes mediate the effect of trait negative affectivity on symptom overreporting [7,17**; see Table 1], whereas reappraisal during the experience or a focus on sensory rather than on affective aspects of the experience counteracts overreporting in anxious persons [18**,88].

An interesting new hypothesis is that enhanced affective-motivational responding to threatening somatic events may go at the expense of detailed sensory-perceptual processing, blurring a clear distinction between an emotional and a somatic state. This may explain a number of recent findings. First, high habitual symptom reporters and patients with somatoform disorders show diminished correspondence between induced physiological reactions and self-reported symptoms [81,89]. Second, elevated symptom reports can be elicited in these persons by simply inducing negative affect (through picture viewing) despite the absence of differences in physiological arousal [83,84*,90,91*], suggesting that presenting affective cues substantially biases the experience of a somatic state. Third, patients with somatoform disorder do not exhibit a peak-end memory bias after an experimentally induced dyspnea episode [37,88]: Despite an identical physiological response pattern compared to healthy controls, exhibiting a clear peak and an end with lower intensity, patients' retrospective integration of the symptom episode was not affected by the actual changes in symptoms over the period. Fourth, when given health-related cue words for autobiographical memory retrieval, patients with somatoform disorder exhibit reduced autobiographical memory specificity after controlling for depression

and rumination [92**]. Also this finding suggests that somatoform patients process and encode health-related episodes in memory in a little detailed way. Fifth, retrospectively reported symptom intensity of a distressing somatic experience increases over a two-week period in high habitual symptom reporters [17**]. Interestingly, by manipulating the processing focus towards affective aspects while experiencing a symptom episode this effect is reproduced regardless of pre-exisiting individual differences, whereas focusing on sensory-perceptual aspects eliminates this effect [88]. These results consistently suggest that understanding elevated symptom reporting in high habitual symptom reporters and in patients with somatoform disorder may shed light on the specific way they have experienced and encoded symptom episodes and retrieve them from memory when reporting symptoms in response to questions and questionnaires.

Implications for future research

Research conducted in the past two decades has considerably changed our view on assessment of bodily (and other) symptoms. It became clear that several variables moderate which type of information is reflected in the ratings and that different types of information may be relevant for different types of outcomes. It is obvious that further investigation of the psychological processes by which a response to a question comes about is of paramount importance in two ways: first, to improve measurement procedures and, second, to understand how psychological processes leading to systematic bias in particular patient groups may be intertwined with and inform about pathological processes, and, as such, provide a window for intervention.

As to the first goal, measuring symptoms and more broadly, health and well-being, in an accurate, valid and reliable way, EMA is uniquely indicated to capture levels,

variability, temporal relationships and context-dependency of self-reported health-related variables [e.g., 93]. The increasing availability of wearable technology and body sensors will ever more allow to measure self-reported variables conjointly with (psycho)physiological responses and create unprecedented opportunities to collect data from “experiencing selves” in real time and space. At the same time, these new measurement strategies pose important new theoretical and methodological challenges for the future [94]. But also within the realm of more paper-and-pencil tests, a variety of sophisticated yet practical measures and measurement approaches (e.g. based on item-response theory and computer adapted testing) are increasingly being developed and made available by the Patient-Reported Outcomes Measurement Information System initiative [95].

As to the second goal, the findings above suggesting that an overreactive evaluative system, possibly combined with reduced sensory-perceptual processing, may play a crucial role in systematic symptom overreporting. This may open a window to not only change bias in symptom reporting, but also change the very psycho(patho)logical processes themselves. For example, modulating the affective evaluation of the experience has recently been demonstrated to counteract bias in retrospective self-reports [18**,88,96]. Also improving sensory-perceptual processing by means of interoceptive training reduced the levels of symptom reports in somatoform patients [97], while EMA combined with symptom reattributions in real time resulted in reduced symptom reports [98*].

Another strategy could be used to modify already consolidated memories of health-related events through, for example, a retrieval-induced forgetting (RIF) task. Using this task, Marche, Briere, and von Baeyer [99*] showed that guided recurrent recall of positive details of initial pain memory in children led to forgetting of negative

aspects which subsequently affected coping strategies. Reactivating autobiographical and emotional memories of symptom episodes and subsequently updating them via a process of reconsolidation [e.g., 100,101**] could be a useful strategy to modify somatic memories in patients with somatoform and somatic symptom disorder, which may both help the patient and reduce bias in symptom reporting.

Conclusion

Clinicians and researchers often rely on retrospective symptom reports in clinical interviews and in traditional questionnaires. However, characteristics of the somatic experience, the retention interval as well as state and trait-related individual differences may influence and bias these reports. Recent research suggests that questions prompting the respondent to provide symptom reports may probe different types of information depending on the recall period. Each type of information is predictive of different outcomes. Understanding stable individual differences in symptom overreporting in somatoform disorders or somatic symptom disorders may also provide a window into pathological processes involved in experiencing and encoding somatic experiences that can be targeted for intervention.

Key points

- Retrospective symptom reports in clinical interviews and in traditional questionnaires are often biased.
- Characteristics of the somatic experience, the retention interval, and state and trait-related individual differences are important biasing factors.
- Questions prompting the respondent to provide symptom reports may probe different types of information depending on the recall period. Each type of information is predictive of different outcomes.
- Stable individual differences in symptom overreporting in somatoform disorders or somatic symptom disorders are related to psycho(patho)logical processes involved in experiencing and encoding somatic experiences that can be targeted for intervention.

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Table 1. Factors affecting accuracy and bias of retrospective symptom reports.

Factor	Effect	Symptom
Characteristics of somatic experience		
Variability of symptom levels in real time	Higher variability related to: symptom overreporting higher recall discrepancies accurate recall	 pain [28], headache [29]; fatigue [30]; pain [31,32]
Intensity of peak and end of symptoms	The most intense (peak) and final (end) moments of experience determine retrospective evaluation while duration is largely neglected (known as peak-end effect)	pain [33–36], dyspnea [17**,37]
Intensity of initial symptoms	Higher initial intensity related to: higher overreporting lower recall discrepancy underestimation	 pain [12]; fatigue [30]; pain [38]
Intensity of symptoms at retrieval	Higher symptom intensity at recall related to greater overreporting	pain [11,39,40], dyspnea [41]
Retention interval	Longer time periods are related to a decrease in correspondence/greater overreporting	pain [10,38], symptoms [42]
Affective state during a somatic experience		
State anxiety	Higher state anxiety related to greater overreporting	pain [7,43]
State distress	Higher state distress related to greater overreporting	pain [44], negative memories [9]
State negative affect	Higher state negative affect related to overreporting	pain [16,17**,45], dyspnea [17**]
Recalled affective state	Higher recalled state anxiety is related to higher retrospective ratings	pain intensity and unpleasantness [21*,46*]
Individual differences (trait)		

Anxiety	Higher anxiety related to greater overreporting	negative/unpleasant affect [47], pain [8,48], pain-related fear [7], symptoms [49]
Anxiety sensitivity	Higher anxiety sensitivity related to greater overreporting	pain [18**], pain-related fear [7]
Negative affectivity	Higher negative affectivity related to:	
	greater overreporting	symptoms [50], negative affective states [51,52], pre-treatment distress [22];
	underestimation	positive emotions [52]
Depression	Higher depression related to:	
	greater overreporting	negative emotions [52], symptoms [49];
	lower recall discrepancy	fatigue [30]
Catastrophizing	Higher catastrophizing related to:	
	lower recall discrepancy	fatigue [30], pain [39];
	higher retrospective ratings	pain [6*]
Self-esteem, optimism	Higher self-esteem and optimism related to:	
	overreporting	positive emotions [52];
	underestimation	negative emotions [52]